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APPLICATION FOR U.S. LETTERS PATENT

Title:

ELECTRICAL EQUIPMENT HOUSINGS HAVING A HORIZONTALLY MOUNTED CONNECTION PLANE

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ELECTRICAL EQUIPMENT HOUSINGS HAVING A HORIZONTALLY MOUNTED CONNECTION PLANE

DESCRIPTION OF RELATED ART

[0001] It has become common to arrange electrical equipment housings, such as computers and the like, with a back-plane having thereon a plurality of connectors. These connectors are adapted for mating with electrical equipment, such as PC boards, which in turn are used to control the equipment. When the system is in operation, the electrical components generate heat that must be removed in order to prevent system failures. The ability to remove heat is a gating factor as to the number of electrical components that can be positioned within a given size of housing.

[0002] It has also become common to force air through electrical equipment housings to remove heat from the equipment. Increasing air flow is a major factor in increasing heat removal. However, there is a practical limit to the air flow capacity of a given housing. Because the back-plane upon which the equipment is mounted is positioned in the air flow path, the back-plane itself impedes air flow through the housing.

BRIEF SUMMARY OF THE INVENTION

[0003] In one embodiment, there is described a housing for mounting electronic boards therein, the housing having at least one horizontally positioned plane, adapted for allowing a plurality of electronic circuits to be connected thereto. The plane is arranged to allow air to flow between opposing walls of the housing without causing the air to traverse bends. The electronic circuits may be positioned on both the top and bottom surface of the horizontal plane. In one embodiment, the housing is a computer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIGURE 1 shows a perspective view of one embodiment of an electrical equipment housing;

[0005] FIGURE 2 shows a side sectional view of the housing taken along line 1B-1B of FIGURE 1;

[0006] FIGURE 3 is one embodiment of an electronic board;

[0007] FIGURE 4 shows a side view of the housing of FIGURE 1 just prior to the insertion of a first electronic board; and

[0008] FIGURE 5 shows one embodiment of multiple electronic boards inserted on the top and bottom surfaces of a horizontally positioned mounting surface.

DETAILED DESCRIPTION

[0009] FIGURE 1 shows one embodiment of housing 10 in which electrical components, such as electronic boards 30 are positioned. Housing 10 has front vertical surface 101 having contained therein, if desired, an opening for the insertion of the electronic boards, such as electronic boards 30-1U to 30-NL. In the embodiment shown, horizontal mounting structure 12 has mounted thereon connectors 13 adapted for receiving contacts 33 (shown in FIGURE 3) of the electronic boards. In FIGURE 1, the electronics boards are plug-in circuit boards of a computer.

[0010] In the embodiment shown, mounting structure 12 (which is the mounting plane for the plug-in boards) has connectors 13 mounted on both its top and bottom surfaces. Note that in other embodiments the connectors may be mounted only on one surface and, if desired, there may be multiple mounting structures (not shown) stacked within the housing. It is contemplated that those surfaces would all be horizontal, but some could, if desired, be vertical. As will be discussed, air can flow between front vertical surface 101 and back vertical surface 103 such that the air traverses the area essentially parallel to mounting surface 12 and in-line with the electronic boards mounted to surface 12. As shown, the electronic boards are mounted perpendicular to mounting surface 12, but could be mounted at any angle thereto. While plug-in wiring boards are shown, any type of component could be attached to surface 12 using, for example, a pigtail electrical connection and a mechanical support.

[0011] One system that is particularly adaptable for the arrangements discussed here is a computer system wherein each plug-in board is a blade of the system, such blade typically contains all of the elements of a traditional computer, namely processors, memory, and I/O. The air flows along the plane of mounting surface 12 and in-line with the electronic boards, the air need not bend around either the mounting surface or the components mounted on the electronic boards. This moving air is free to impact components mounted on both sides of the mounted electronic boards and thus can carry heat away from both sides of the boards.

[0012] Fan 102, shown mounted in the back vertical surface opposite the front vertical surface, causes air to flow between the front and back vertical surfaces. The fan could be designed to blow air in or suck air out as desired. Also, as will be discussed, the fan (or a number of fans) could be mounted internally within housing 10 as well. Also, in some situations, the fan could be eliminated, allowing natural convection to carry heat away from the components.

[0013] As shown in FIGURE 1, any number of plug-in boards 30 may be mounted on surface 12. In this embodiment, boards 30-1U to 30-NU are shown plugged into connectors on the top surface of structure 12 while boards 30-1L to 30-NL are shown plugged into connectors on the bottom (or underside) of surface 12.

[0014] FIGURE 2 shows a side sectional view of housing 10 taken along section line 1B-1B of FIGURE 1. Electronic board 30-NU is shown plugged into connector 13-NU mounted on the top surface of structure 12 and electronic board 30-NL is shown plugged into connector 13-NL mounted on the bottom surface of structure 12. Air 104, controlled in part by fan 102, is shown flowing from back vertical panel 103 and out front vertical panel 101. As can be seen, this air flows essentially parallel to structure 12 without traversing around bends. This air will flow easily past all of the electronic components mounted on both the top and, if desired, bottom surfaces of structure 12 without mechanical hindrance.

[0015] Electronic boards 30 may be inserted into the various connectors 13 for example, by opening a door (not shown) in the vertical panel or by removing the panel. The board to be inserted is first positioned over (or under) the desired connector and then pressed downward (or upward) for insertion into the connector. Once in place, friction (and/or locking mechanism) between the connector and the pins of the electronic board maintains the board in mating relationship. Alternatively, a bracket (not shown) can be used to hold the board and the connector together, if desired.

[0016] FIGURE 3 shows one embodiment 30 of an electronic board having contacts 33 for mating with connector 13. Mounted on board 30 are components 34. Not shown are components mounted within or on the other side of board 30. Fan 35 is shown and maybe optionally mounted on one or more boards as desired. Fan 35 may be used in conjunction with, or as a substitute for, fan 102 (FIGURE 1). The system could be designed such that each board (or each group of boards) contains its own fan so that as the system grows (i.e., more and more

boards connected within housing 10), the air moving capability would also grow in direct proportion to the number of connected boards.

[0017] FIGURE 4 shows a side view of housing 40 just before board 30-1U is inserted downward into connector 13 mounted on the top surface of horizontal structure 12. Board 30-1U is positioned over connector 13 by insertion through an opening in front vertical surface 101 as previously discussed. Mounting structure 42 is the same as structure 12 (plane 3) except that both the top and bottom surfaces of structure 42 contain dual rows of connectors for higher density. Also, structure 42 of housing 40 has fan 41 positioned thereon. Housing 40 is shown with communication devices 111, data storage devices 112 and power supply 110, one or more of which devices would typically be found within a computer. Other such devices can also be contained within the housing, if desired. In some cases, these devices could also be plugged into a connector positioned on structure 42.

[0018] FIGURE 5 shows housing 40 having several plug-in boards mounted therein in dual upper and dual lower rows. Boards 30-NUF to 30-NUB are shown on the top surface of structure 12 while boards 30-NLF to 30 NLB are shown plugged upward onto the bottom surface. Fan 41 draws air 301 in through vents in front surface 101 and causes the air to flow past all of the boards plugged into connectors on the bottom surface of mounting structure 42. The air is forced out of vents in vertical back surface 103. Air flow on the top of surface 42 could be controlled in a similar fashion, or could be controlled by a fan in one or more of the vertical surfaces or by fans connected to one or more electrical boards 30. This then allows for dual airflow control.

[0019] While, in theory, the air could move in other directions (for example, air drawn in through the front and rear and forced out through the top and bottom) through housing 40, this is not practical because the housings are often mounted into a system with their respective sides in close proximity to each other.